


**Humeral Nonunions:
Issues and Strategies?**

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15 minutes

Disclosure

Consultant

- Biomet
- Smith and Nephew


Royalties

- Biomet
- Smith & Nephew
- Advanced Orthopedic Systems

Humeral Shaft Fractures

- Healed and well-aligned

“UNION”




97%

Humeral Shaft Fractures

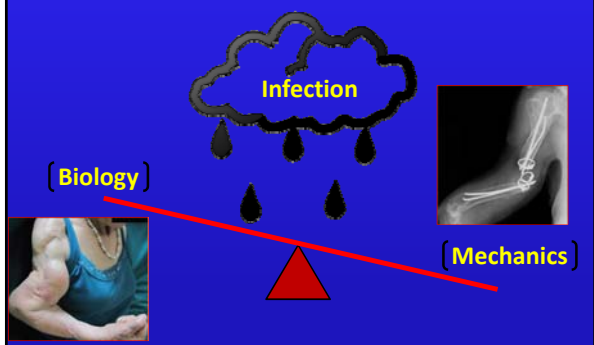
- Unhealed and well-aligned
- Healed and poorly-aligned
- Unhealed and poorly aligned

**“NONUNION
(or MALUNION)”**

3%



Humeral Shaft Nonunions



Infection

Biology

Mechanics

Humeral Shaft Nonunions

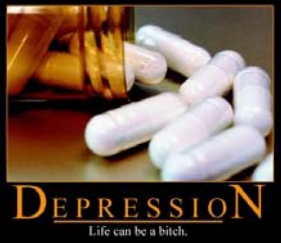
- Nonunion is predictable in some

Limb	Host
• Proximal 1/3	• Diabetes
• Open fracture	• Nicotine
• High-energy	• NSAIDs
• Comminution/ bone loss	• Thyroid
• Infection	• Immune disorders
	• Testosterone
	• Vitamin D
	• Cancer drugs

Humeral Shaft Nonunions

Patients

- The D's
- Disabled
- Depressed
- Destitute




If you help them they are *Darn thankful!*

Humeral Shaft Nonunions

Treatment

- Challenging problems
- Thoughtful intervention
- No cookbook answers
- Creative solutions




A number of generalizations exist which will help you provide a customized Rx plan

Humeral Shaft Nonunions

A thoughtful approach....

- Host
- Bone
- Soft tissues
- Alignment
- Infection




Humeral Shaft Nonunions

- **General Approach**
 - Why is it not healed?
 - Host problems- correctable?
 - Limb problems- correctable?
 - Is it infected?
 - How long will fracture stability be maintained?

Humeral Shaft Nonunions

Host problems: Correctable?

- A long list.....
 - Nicotine
 - NSAIDs
 - Thyroid
 - Testosterone
 - Vitamin D
 - Diabetes
 - Hepatitis
 - Immune disorders
 - Cancer drugs

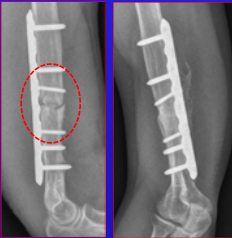


- If so, WE SHOULD CORRECT THEM!

Humeral Shaft Nonunions

Atrophic (oligo or hypo-trophic)

- Lack of callus (healing)
- "Avascular"
- Failure of healing cascade
- Factors
 - Host
 - Limb




Solution: ***BIOLOGIC!***

Humeral Shaft Nonunions

Atrophic (oligo or hypo-trophic)

- Lack of callus (healing)
- "Avascular"
- Failure of healing cascade
- Factors
 - Host
 - Limb




Solution: **BIOLOGIC!**

Humeral Shaft Nonunions

Hyper-trophic nonunions

- Lots of callus
- "Vascular"
- Mechanically unstable
- Factors
 - Rx failure?




Solution: **MECHANICAL STABILIZATION!**

Humeral Shaft Nonunions

Infection must be "ruled out"

- History
- Examination
- Sedimentation rate, C-reactive protein
- Nuclear medicine
- MRI (CT)
- Culture
- Pathology

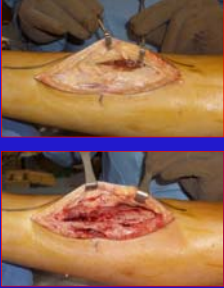


Humeral Shaft Nonunions

Infection *must* be "treated"

- Debridement
- IV ABX
- Local ABX
- Wound coverage (Plastics)
- (Suppressive ABX)

Will defer to afternoon talk




Humeral Shaft Nonunions

Fixation	(+)	(-)
• IM nail	Implant life Stability Familiar	Retained implant Shoulder pain
• Plates/ screws	Ease of use Familiar	Retained implant Larger dissection
• External fixation	Less dissection No retained implant Flexibility of usage	Less familiar Additional surgeries

A Few Cases

Case 1: History


- 68 yo woman
- BMI 38
- 2 years from fracture
- Nailed 3 mos later
- Shoulder pain 2/10
- Mid arm pain 4/10



Case 1: History

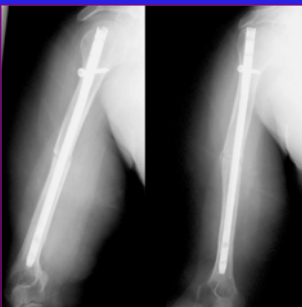
- 58 yo woman
- BMI 38
- 2 years from fracture
- Nailed 3 mos later
- Shoulder pain 2/10
- Mid arm pain 4/10

?




Case 1: History

- Nicotine?
- Medical Hx?
 - Thyroid
 - Hormones
 - Vit D
 - Osteoporosis
 - Prior NU
- Medications?
 - Chemo
 - Psychotropics
 - Seizure
 - Osteoporosis



Case 1: History

- Nicotine?
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Low Vit D
Osteopenia

Case 1: History

- # surgeries
- Infection Hx
- Persistent drainage
- Wound problems
- Given ABX
- Fevers/chills



Infection risk is low

Case 1: History


- # surgeries
- Infection Hx
- Persistent drainage
- Wound problems
- Given ABX
- Fevers/chills



Infection risk is low

Case 1: Tests

- Basic anesthesia labs
- CBC
- C-reactive protein
- Sed rate
- Thyroid
- PTH
- Vit D
- Hormones



Infection

Union

Case 1: Summary

- Bone metabolism?
- Low probability infection?
- Treat Vit D
- Await labs
- Await labs

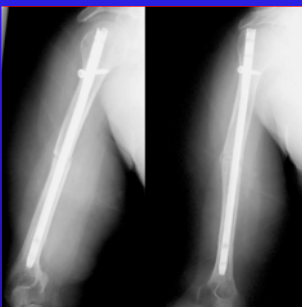
Start surgical planning

Case 1: Surgery

- Address hardware
- Fixation construct
- "Graft"

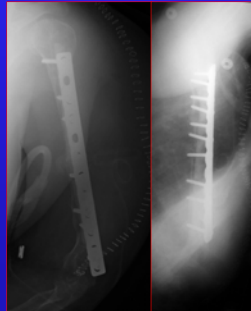
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- Approach
- Set-up

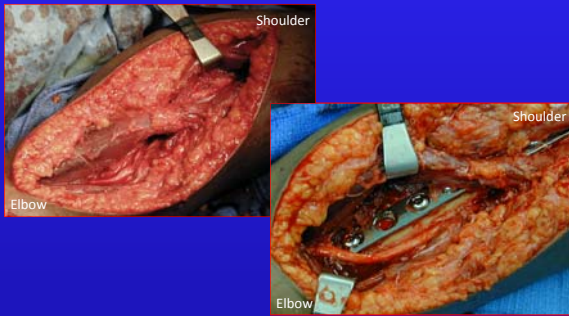


Debride & Fixation Construct

- Remove nail
- AL approach
- Freshen bone ends/ NU
- Deep culture
- Fibular allograft
- Long 4.5mm plate
- Compression applied
- Autograft (Gerdy's)



Anterolateral Approach



Radial Nerve Protection

- Tale of 2 outcomes



Follow-up

6 months

Spine X-rays

Case 2

- 48 yo woman
- BMI 37
- Polytrauma
- 9mos from fracture
- Mid arm pain 4/10

Humeral X-rays

Case 2: History

- Nicotine?
- Medical Hx?
 - Thyroid
 - Hormones
 - Vit D
 - Osteoporosis
 - Prior NU
- Medications?
 - Chemo
 - Psychotropics
 - Seizure
 - Osteoporosis


Humeral X-rays

Low Vit D
Hypothyroid
Distal femur NU

Case 2: History

- # surgeries
- Infection Hx
- Persistent drainage
- Wound problems
- Given ABX
- Fevers/chills

Infection risk is low




Case 2: Tests

- Basic anesthesia labs
- CBC
- C-reactive protein
- Sed rate
- Thyroid
- PTH
- Vit D
- Hormones

Vit D risk is low
TSH is low
Endocrine consult

Infection

Union

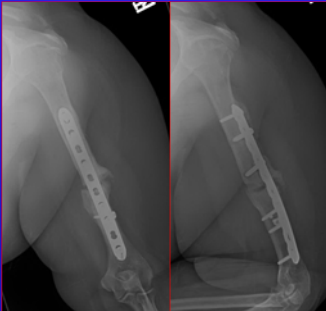


Case 2: Surgery

- Address hardware
- Fixation construct
- No "Graft"?

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- Approach
- Set-up



Debride & Fixation Construct

- Posterior Approach
- Remove plate
- Examine bone > Cx
- Long 4.5mm plate
- Compression applied



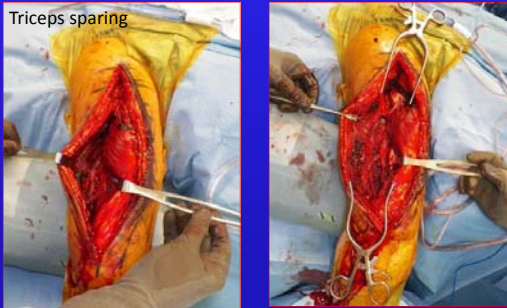
Posterior Approach

Triceps splitting




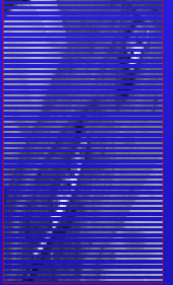
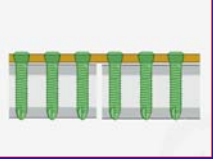
Posterior Approach

Triceps sparing



Locked Plating

- Fixed angle device
- Lots of screws
- Open approach



Case 2: Follow-up


8 months



Humeral Shaft Nonunions

Treatment

- Challenging problems
- Thoughtful intervention
- No cookbook answers



A number of generalizations exist which will help you provide a customized Rx plan

